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Spray-occasions: June 1982 to May 1983

by

E SPACKMAN

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E A SPACKMAN

Agro-meteorology Department, MAFF/ADAS, Brooklands Avenue, Cambridge

Summary This paper presents estimates of the number of spray-occasions during the 1982/3 season calculated from meteorological data. The estimates are compared with averages for 1970/83. The calculations are based on criteria developed for 'residual' and 'contact' types of herbicide.

INTRODUCTION

Spray-occasions analyses have now been presented at each Herbicide Review since 1979. Adams (1979, 1980) developed criteria, based on meteorological data, designed to permit comparisons to be made between spraying opportunities for herbicides at different places and in different seasons. Spackman and Barrie (1981) and Spackman (1983) have extended the analysis to include data from 15 stations covering the UK. The criteria used were considered to be broadly appropriate for hormone type chemicals whilst a Soil Moisture Deficit parameter for bare soil enabled one to compare the opportunities for spraying using Conventional vehicles or Low Ground Pressure vehicles. Of course, crops and variations in soil types and structures will lead to variations in the actual number of occasions when a Conventional vehicle could be used in a particular field.

The criteria have now been refined to represent conditions considered suitable for spraying herbicides with different types of chemical.

CRITERIA

Adams (1979) provides a discussion on the choice of criteria and the application of the technique. The new criteria (see Table 1) have been chosen to define suitable conditions for 4 different types of chemical - residual, contact, contact-hormone and hormone. It can be seen that more specific conditions of temperature and rainfall are now taken into account. Data for January 1970 to May 1983 have been analysed and suggest that there is little difference between the average number of spray-occasions for contact, contact-hormone and hormone chemicals. The main difference occurs in spring when there are a few more occasions for spraying contact-hormone type chemicals than contact or hormone types. This paper presents results for residual and hormone types only.

The criteria are designed for comparison of places and seasons; they do not take into account the state of the crop or weedthat may be sprayed nor do they take into account the precise wind and turbulence conditions under which a sprayer might be used.

STATIONS

The results of previous analyses using 15 stations (eg Spackman and Barrie (1981)) suggest that the main features of a season are on a large scale and that rather fewer stations can be used to indicate the scale of variation across the UK. This paper uses data from 5 stations:

Kinloss, Grampian - about 50 km east north of Inverness
Aldergrove, N Ireland - about 20 km west of Belfast
Waddington, Lincolnshire - about 10 km south of Lincoln
Boscombe Down, Wiltshire - about 40 km north west of Southampton
Mount Batten, Devon - just south of Plymouth

RESULTS

Average and lower quart (viz the value not exceeded on average one occasion in four) have been calculated for each month from January 1970 to May 1983. Values are given in Table 2 for Conventional vehicles and in Table 3 for Low Ground Pressure vehicles. It may be noted that the old (Adams) criteria give values between those for the hormone and residual types of chemical.

Spray-occasions 1982/3

The number of spray-occasions for June 1982 to May 1983 are given in Table 4. Differences from average are presented in Table 5.

Conventional vehicles

Summer 1982. In June and July conditions were a little above average at Kinloss and Aldergrove; in July they were also above average at Mount Batten. August was a very poor month everywhere and at Kinloss and Aldergrove there were only about one-third the normal number of occasions.

Autumn 1982 and Winter 1982/3. In September the number of spray-occasions was below average at Kinloss and rather above average at Boscombe Down and Mount Batten. October was below average and so apart from a few occasions in October at Kinloss there were no further spray-occasions at any of the stations until February. Except at Mount Batten February was above average everywhere but the number of spray-occasions was not greater than five.

Spring 1983. March was a near normal month though above average at Mount Batten. April was considerably below average at Waddington (with only 3 spray-occasions) and above average at Kinloss; elsewhere values varied from near average to somewhat below. In May values were again rather low at Waddington and mostly below average elsewhere.

Low Ground Pressure vehicles

The benefit of these vehicles compared with Conventional vehicles should have been realised in most places from August through to May though for hormone chemicals in winter the benefits are minimal with very few spray-occasions anyway. The greatest benefits (viz 10 or more extra occasions for residual chemicals) occurred in October (except at Kinloss) in December at Boscombe Down and Mount Batten, in February at Kinloss, in March at Aldergrove, in April at Aldergrove, Waddington and Mount Batten, and in May at Waddington. Special mention must be made of Waddington in April and May with 40 extra occasions for residual chemicals and 23 for hormone chemicals; the spray-occasions were raised from much below average for Conventional vehicles to above average for Low Ground Pressure vehicles.

Spring 1983 - favourable or unfavourable?

Spring is a particularly significant time for spraying herbicides. Table 6 gives the total spray-occasions for March to May for hormone type chemicals using

Conventional vehicles and the additional occasions obtained if using Low Ground Pressure vehicles. It is seen that for Conventional vehicles in Spring, 1983 was a rather poor year at Waddington; elsewhere it was not exceptional. However, 1983 does stand out for Low Ground Pressure vehicles for which the number of occasions gained over Conventional vehicles at all stations except Kinloss was exceptional; 1983 provided well above the average number of occasions at all stations.

CONCLUSION

There was considerable variation in spray-occasions from month to month when compared to average. The main events to note are the very low values in August at most stations and in April and May for Conventional vehicles at Waddington. The use of Low Ground Pressure vehicles during spring should have been of considerable benefit at all stations.

ACKNOWLEDGEMENTS

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Any comments on this paper should be addressed to the author

E Spackman
Region Agro-meteorological Officer
MAFF/ADAS
Brooklands Avenue
Cambridge

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Table 1

Spray-occasion criteria

Constraint	Conditions	Chemical type* R	C	CH	H
Operations	Daylight - but between 06 GMT and 20 GMT				
	Temperature > 1°C				
	No standing water, glaze, frozen ground or snow lying at 12 GMT				
	Visability > 100 metres				
	Spray period - 5 consecutive hours				
Sprayer	Wind speed ≥ 2 knots (about 1 ms^{-1})				
	Wind speed ≤ 9 knots (about 5 ms^{-1})				
	(Wind speeds are measured at 10m above ground)				
Vehicle	For Conventional vehicles the Soil Moisture Deficit using a bare soil model must exceed 5mm.				
Chemical					
- Temperature	> 1°C next night		o	o	o
	Day Maximum > 10°C				o
- Relative Humidity	> 80% if temperature < 10°C		o		
	< 95%			o	o
- Rain	< 1 mm in any hour	o			
	< 0.1 mm in any hour		o	o	o
	< 0.1 mm in each of 3 hours after spraying		o	o	o
	< 2 mm total in 9 hours commencing 3 hours before spraying		o	o	o

* R - Residual
C - Contact
CH - Contact-hormone
H - Hormone

Table 2

Spray-occasions for Conventional vehicles

(January 1970 - May 1983)

Chemical and station	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
						Average						
Residual - Kinloss	0	2	7	16	22	24	25	27	14	7	1	0
Aldergrove	0	0	4	17	21	23	26	27	12	3	0	0
Waddington	0	0	4	15	21	26	29	27	20	9	1	0
Boscombe Down	0	0	4	13	19	25	27	28	17	7	2	0
Mount Batten	0	0	5	15	19	23	25	26	15	7	1	0
Hormone - Kinloss	0	0	1	8	15	18	19	21	12	5	0	0
Aldergrove	0	0	1	11	16	20	22	23	10	2	0	0
Waddington	0	0	2	8	16	22	25	21	17	6	0	0
Boscombe Down	0	0	2	8	15	22	24	24	14	4	0	0
Mount Batten	0	0	3	11	15	19	21	23	14	6	1	0
						Lower quart						
Residual - Kinloss	0	0	1	6	15	22	21	22	5	0	0	0
Aldergrove	0	0	0	9	16	17	19	20	3	0	0	0
Waddington	0	0	0	9	16	21	25	22	19	0	0	0
Boscombe Down	0	0	0	9	12	20	22	24	12	0	0	0
Mount Batten	0	0	1	9	13	18	20	19	12	0	0	0
Hormone - Kinloss	0	0	0	2	9	16	14	17	3	0	0	0
Aldergrove	0	0	0	5	10	14	16	17	2	0	0	0
Waddington	0	0	0	4	12	17	21	17	14	0	0	0
Boscombe Down	0	0	0	5	8	17	19	17	10	0	0	0
Mount Batten	0	0	0	6	10	16	16	17	8	0	0	0

Table 3

Spray-occasions for Low Ground Pressure vehicles

(January 1970 - May 1983)

Chemical and station	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
						Average						
Residual - Kinloss	5	9	13	19	23	25	26	30	18	13	7	5
Aldergrove	6	10	13	23	25	26	29	32	19	16	7	7
Waddington	5	9	13	20	24	27	31	31	23	17	8	5
Boscombe Down	6	8	11	16	20	26	28	30	20	14	9	6
Mount Batten	7	10	12	18	20	23	26	28	21	15	8	7
Hormone - Kinloss	0	1	2	8	15	19	20	23	14	7	1	0
Aldergrove	0	1	3	14	18	22	24	26	14	10	1	0
Waddington	0	0	4	10	18	23	26	24	18	9	1	0
Boscombe Down	1	1	3	9	16	23	24	25	15	8	1	0
Mount Batten	1	1	5	13	17	19	22	24	17	10	3	1
						Lower quart						
Residual - Kinloss	2	6	8	11	15	21	21	25	13	9	5	2
Aldergrove	4	5	9	18	18	21	21	27	13	13	5	5
Waddington	4	5	8	16	18	24	26	29	20	14	6	4
Boscombe Down	4	4	6	11	13	21	22	26	16	11	8	4
Mount Batten	5	5	8	15	15	19	21	21	16	12	6	4
Hormone - Kinloss	0	0	0	3	9	16	14	20	9	4	0	0
Aldergrove	0	0	0	7	10	15	16	20	9	7	1	0
Waddington	0	0	1	4	12	20	22	21	16	7	0	0
Boscombe Down	0	0	1	5	8	18	17	18	13	5	1	0
Mount Batten	0	0	1	7	11	16	18	18	13	7	1	0

Table 4

Spray-occasions: 1982/3

Chemical and station	1982 Jun	Jul	Aug	Sep	Oct	Nov	Dec	1983 Jan	Feb	Mar	Apr	May
Conventional vehicles												
Residual – Kinloss	26	35	10	9	3	0	0	0	5	3	24	23
Aldergrove	26	34	12	14	0	0	0	0	4	2	10	17
Waddington	26	28	18	22	0	0	0	0	2	5	3	12
Boscombe Down	24	27	26	30	0	0	0	0	3	4	10	14
Mount Batten	19	30	17	30	0	0	0	1	1	9	13	17
Hormone – Kinloss	23	30	7	9	2	0	0	0	4	3	14	16
Aldergrove	23	31	8	11	0	0	0	0	3	2	5	15
Waddington	23	23	15	19	0	0	0	0	0	5	3	9
Boscombe Down	21	23	17	21	0	0	0	0	0	4	7	11
Mount Batten	15	26	12	23	0	0	0	1	0	6	12	11
Low Ground Pressure vehicles												
Residual – Kinloss	27	35	13	18	7	8	4	0	18	9	24	23
Aldergrove	27	34	16	17	21	5	9	1	10	18	23	23
Waddington	29	28	22	26	15	6	6	1	4	9	23	32
Boscombe Down	26	27	26	30	14	6	10	4	4	12	16	20
Mount Batten	24	32	18	31	15	6	10	5	4	16	23	20
Hormone – Kinloss	23	30	9	12	5	3	1	0	5	8	14	16
Aldergrove	23	31	12	12	11	1	0	1	4	12	11	19
Waddington	25	23	16	22	7	0	0	1	0	7	12	23
Boscombe Down	23	23	17	21	9	1	0	3	1	8	12	16
Mount Batten	18	27	12	24	10	1	0	3	2	11	20	14

Table 5

Spray-occasions: 1982/3 - difference from average for January 1970 to May 1983

Chemical and station	1982 Jun	Jul	Aug	Sep	Oct	Nov	Dec	1983 Jan	Feb	Mar	Apr	May
Conventional vehicles												
Residual – Kinloss	+2	+10	-17	-5	-4	-1	–	–	+3	-4	+8	+1
Aldergrove	+3	+8	-15	+2	-3	–	–	–	+4	-2	-7	-4
Waddington	0	-1	-9	+2	-9	-1	–	–	+2	+1	-12	-6
Boscombe Down	-1	0	-2	+13	-7	-2	–	–	+3	0	-3	-5
Mount Batten	-4	+5	-9	+15	-7	-1	–	–	0	+4	-2	-2
Hormone – Kinloss	+5	+11	-14	-3	-3	–	–	–	+4	+2	+6	+1
Aldergrove	+3	+9	-15	+1	-2	–	–	–	+3	+1	-6	-1
Waddington	+1	-2	-6	+2	-6	–	–	–	0	+3	-5	-7
Boscombe Down	-1	-1	-7	+7	-4	–	–	–	0	+2	-1	-4
Mount Batten	-4	+5	-11	+9	-6	-1	–	–	0	+3	+1	-4
Low Ground Pressure vehicles												
Residual – Kinloss	+2	+9	-17	0	-6	+1	-1	-5	+9	-4	+5	0
Aldergrove	+1	+5	-6	-2	+5	-2	+2	-5	0	+5	0	-2
Waddington	+2	-3	-7	+3	-2	-2	+1	-4	-5	-4	+3	+8
Boscombe Down	0	-1	-4	+10	0	-3	+4	-2	-4	+1	0	0
Mount Batten	+1	+6	-10	+10	0	-2	+3	-2	-6	+4	+5	0
Hormone – Kinloss	+4	+10	-14	-2	-2	+2	+1	0	+4	+6	+6	+1
Aldergrove	+1	+7	-14	-2	+1	0	0	+1	+3	+9	-3	+1
Waddington	+2	-3	-8	+4	-2	-1	0	+1	0	+3	+2	+5
Boscombe Down	0	-1	-8	+6	+1	0	0	+2	0	+5	+3	0
Mount Batten	-1	+5	-12	+7	0	-2	-1	+2	+1	+6	+7	-3

Table 6

Spray-occasions: March to May for hormone chemicals

Conventional vehicles

	Kinloss	Aldergrove	Waddington	Boscombe Down	Mount Batten
1970	10	16	21	20	24
71	29	35	29	25	36
72	27	21	21	21	15
73	12	19	45	22	32
74	24	45	24	33	35
75	18	36	25	27	33
76	28	32	24	28	38
77	16	34	12	11	24
78	34	43	37	30	36
79	4	4	13	18	18
80	40	40	34	38	38
81	27	18	21	8	21
82	31	34	52	46	51
83	33	22	17	22	29

Additional occasions with Low Ground Pressure vehicles

	Kinloss	Aldergrove	Waddington	Boscombe Down	Mount Batten
1970	0	3	0	0	1
71	0	3	3	1	3
72	0	10	13	2	3
73	1	2	2	0	1
	1	0	1	5	6
1975	5	10	11	2	2
76	0	4	0	1	2
77	5	0	2	3	1
78	4	5	1	7	4
79	3	12	5	4	2
1980	0	2	7	3	1
81	2	11	5	2	2
82	0	2	14	0	1
83	5	20	25	14	16